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No. 7

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CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

GLUSHKOV INTERVIEW ON 25TH ANNIVERSARY OF FIRST SOVIET COMPUTER

Kiev RABOCHAYA GAZETA in Russian 25 Dec 76 p 4

[Interview with Viktor Mikhaylovich Glushkov, Director of the Institute of Cybernetics of the Academy of Sciences of the Ukrainian SSR, in the column "Reporter's Notebook": "From the Computer to 'Artificial Intelligence'; The Second Birth of an Ancient Craft; The EVM Overtakes Fantasy: Academician Gives Interview"]

[Text] Today marks 25 years since the day of the official reception (1951) of the first general purpose electronic digital computer MESM (small electronic computer) in the Soviet Union. Yesterday, our correspondent met with academician V. M. Glushkov, Director of the Institute of Cybernetics of the AN USSR [Academy of Sciences of the Ukrainian SSR], Hero of Socialist Labor, laureate of the Lenin and State Prizes, and asked him to respond to several questions.

[Question] Viktor Mikaylovich, please tell us about the beginnings of cybernetics.

[Answer] Immediately after the war, when the restoration of the national economy, which had been wrecked by the enemy, was started, Soviet scientists began working energetically on creating electronic computing equipment. American specialists were also conducting research in this area. The necessity to build EVM [computers] was dictated by the fact that the by then rapid development of many branches of science, and first and foremost solid state physics and nuclear physics, as well as missile technology, required very complex calculations.

At the cradle of the first domestic computer stood former vice president of the AN USSR, M. Lavrent'yev. Endowed with a sense of the new, he supported a group of young Kiev engineers who had a burning desire to implement cybernetic ideas into practice. The group was headed by academician of the AN USSR, S. Lebedev.

Those were difficult times. There was no laboratory base. But nevertheless, the collective of enthusiasts labored fruitfully. The scientists came up with many completely original solutions to the complex problem and by 1950 had built a working prototype, and a year later the MESM itself. It is interesting that it was more modern than the American computers known at that time.

Thus, about the same time, our researchers, independently of U. S. scientists, realized theoretical ideas which had soared into the air, and at a higher scientific level. We consider the day when the MESM was placed into operation by the State Commission under the chairmanship of academician M. Keldysh as the official date of the birth of the firstling of Soviet cybernetics.

[Question] Several researchers suggest that modern cybernetics is not a science. What sort of definition would you give it?

[Answer] In the beginning, there was the word. The ordinary word "kyberneo," which in translation from ancient Greek means "I am directing, I am controlling." The ancient Greeks called the art of steering a ship cybernetics, and the helmsman was called a "kybernetos."

About a 100 years ago, A. M. Ampere made an attempt to systematize science and give it a philosophical foundation. He suggested calling the science of controlling society cybernetics. In 1948 the term was revived by Norbert Wiener, who so named the science of the laws of controlling and transmitting information in living organisms and machines.

Now we are inclined to understand this term more broadly. Cybernetics--this is the science not only of controlling, but also of the general laws of transformation of information in complex systems. Controlling is not obligatory. Information retrieval systems or automated systems for proof of theorems are typical cybernetic and at the same time non-controlling systems although elements of control in the strict sense of the word are peculiar to them.

The radius of operations of cybernetics is moving beyond the limits of control proper. After all, the primary practical problem which it is called upon to solve is creating artificial intelligence.

This is true science, and science not only with a special subject, but also with a special method of research. And not every science is able to "boast about" the latter. Cybernetics gave birth to the method of the mathematical experiment.

An experiment is made not with the very object of study, but with its description and with information about it. In other words, simulation modeling takes place in the computer memory. The object is described in dynamics and we are not at all talking about copying it. It is important to note that in the process a deep mathematical penetration into the depths of the process is not obligatory. And, let us say, the

cybernetic method makes it possible to speed up a thorough study, for example, of large ecological phenomena by billions of times.

Creators of GES earlier conducted experiments on natural models, expensive and unwieldy. Machines also came to their aid. It is not without interest to know that already the first computers conducted simulation modeling of the flight of a projectile much faster than the projectile itself flies.

A fundamentally new method became universally accepted along with the emergence of EVM. It can also be used when researching socioeconomic processes. Accurate mathematical laws do not exist in the field of human relations. But here we can and know how to describe the interactions of people in a model. Sociologists in cooperation with cyberneticists are already modeling the collective. And they would be helpless relying on classical mathematics. After all, its deductive analytic method can be applied to a narrow circle of sciences--to mechanics, physics, part of chemistry, some parts of biology and economics. But use of the modeling technique has practically no bounds.

[Question] How will Soviet cybernetics develop in the next 25 years?

[Answer] Without the use of the latest achievements in the theory and practice of cybernetics further scientific progress is impossible. This is linked to the development of Soviet society and the scientific and technical revolution. Control processes are becoming more complex, the capacities of information flows are becoming higher and higher, new problems are arising to face directors of all ranks, sociologists, technologists and economists. To link scientific achievements with the advantages of the socialist method of economy is possible only if effective use is made of computer technology.

The first fourth generation mini-EVM in the country was created in our institute in this year. In the next 25 years, the first computers with "artificial intelligence" will be created. Thus the role of the EVM in improving control of the country's economy will be significantly strengthened. Speaking of that, already now, if all the computers would stop in the enterprises of the ministries of the electronic industry, instrument building, radio industry, oil and gas industry, then these ministries would not be able to normally perform the tasks levied on them.

Growth of the ASU [automated control system] was envisaged by decision of the 25th CPSU Congress, and not so much quantitative as qualitative. This is especially important for the long range development of cybernetics. After all, the creation of the state automated control system will be completed by the end of this century. Thus, the cyberneticization of economics and science will be developed at accelerated rates.

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

TESTING OF NEW NAIRI-4 COMPUTER COMPLETED

Moscow NEDELYA in Russian 27 Dec 76-2 Jan 77 p 3

[Article by R. Meliksetyan: "Hello, Nairi-4"]

[Text] In the Yerevan Scientific Research Institute for Mathematical Machines government tests of a new computer of the Nairi family have been completed.

The office of the chief designer, which only yesterday was full of people, is now calm. Only mountains of paper covered with writing, and rolls of blueprints remind one of the many days of pressure. The glances of those present time and again meet over the thin blue folder on the edge of the table. Each knows by heart the text of the document contained in it. The document contains evaluations, formulae, tables, numbers, and at the end a conclusion: the machine is good and is recommended for series production.

The name of one of the major specialists in computer technology, academician A. A. Dorodnitsyn appears first. We asked the "godfather" of the Nairi family, as well as of the overwhelming majority of our other computers, to state his opinion of the new machine:

"In basic technical characteristics, as well as in its structural solutions, the Nairi-4 has no analogue; it is superior to existing models of this family and to other domestic computers of a similar class," said Anatoliy Alekseyevich. "For the first time in the USSR a machine has been developed using the principle of nanoprogramming, which provides for the interpretation of a system of micro-commands and the unification of means to control the machine. The physical size of the machine has been greatly reduced, and its reliability increased. Finally, the first memory in the country on cylindrical magnetic tapes of a new type--without destruction of data--has been developed for the Nairi-4. In a word, the latest achievements of electrical design have been used, and a number of structural decisions characteristic of fourth generation computers have been applied."

Every second it performs about 500 thousand operations such as addition, comparison, etc. The capacity of the working storage of the machine

exceeds 64 thousand alpha-numeric characters. Communication with the external world is effected by means of a main channel with a carrying capacity of 30 million bits of information. This makes it possible to use the computer for processing and controlling processes lasting millionths of a second. Along with this it opens up the possibility of simultaneously attaching to it many systems to be checked and controlled.

The creation of the machine required intensive labor from the collective headed by chief designer G. Oganyan and his assistants R. Nalbandyan, Sh. Arutyunyan, and S. Mkrtchyan. E. Dzhandzhulyan--the basic designer of the main channel, A. Sarkisyan, who solved questions on computation, the designer R. Mikayelyan, and the mathematician and programmer G. Aslanyan and others contributed their knowledge, experience, and energy to the new machine.

Today they remember with a smile those four years of searching and suddenly finding, of disappointments and joys. They tell, for example, of how for two days and nights they did not leave the laboratory when the machine suddenly stopped working, how they were looking for the "root of evil" in complicated systems and units, how they performed a multitude of calculations and monitoring tests. And then it was explained: one of the machine's blowers had simply broken down.

In its tests the Nairi-4 worked for 120 hours straight without an interruption--and the developers spent the same amount of time in the institute (they set up folding beds in unoccupied rooms).

What sort of problems can the Nairi-4 solve? Problems in the automating of designers' working areas; secondly, monitoring the quality of radio-electronic apparatus; thirdly, controlling technological process; fourthly, solving problems in air-traffic control around major airports. Wherever it might work, it will facilitate the perfecting of control systems and will lighten and raise the efficiency of human labor.

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CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

COLLECTIVE-USE COMPUTER CENTERS MORE EFFICIENT

Tashkent PRAVDA VOSTOKA in Russian 5 Jan 77 p 3

[Article by Doctor of Economic Sciences and Professor I. Irmatov, Candidate of Physical-Mathematical Sciences K. Babamuradov, and Candidate of Technical Sciences T. Kadyrov: "Joint Computer Use"]

[Text] Today no one would consider building his own personal electric power station or bakery. It would not pay.

We have known for a long time to take everything into consideration when our own money is involved. But when it is a question of state money...

Let us take computer utilization. Today they help control production processes in many sectors of the national economy. Computers are used in planning, engineering-technical computations, accounting, the processing of complex production information, and the performance of many tasks.

The computer is a qualitatively new phenomenon in comparison with all the other machines previously invented by man. The most powerful turbogenerators, although capable of replacing the labor of many millions of men, nevertheless magnify only man's physical power, while the computer amplifies his intellect. Computers, a product of the scientific and technical revolution, have absorbed the labor and experience of many scientists and workers and are themselves capable of accelerating the swift course of the scientific and technical revolution in many ways.

And if the efficient utilization of machinery by the economy constitutes one of the factors in an increase in work quality, it is clear how important it is to efficiently utilize the computer.

Our republic has organized many computer centers that are equipped with modern computers. However, not only ministries and departments but also individual enterprises and organizations install these computers for their own use. And it is no secret that computer efficiency varies greatly. It is not the fault of these intelligent machines that they do not pay for themselves. Those computers that have high loads and that work at full capacity are being efficiently utilized.

For example, take the computer center of the Central Asian Railroad. It was organized in 1973 on the basis of the railroad computer equipment laboratory. There the technical base consisting of a computer complex and a data transmission network was set up at the same time as computer equipment was introduced in the railroad's enterprises.

Now three Minsk computers work there, with additional doubling of the input-output equipment, magnetic drums. The center shares information with all its branches: the Tashkent junction commodity control office; the Bukhara-1, Angren, Akhangaran, Tashkent, Kyzyltukumachi, Samarkand, and Ashkhabad stations; and others. In all, the Tashkent base ASU has the capability of receiving information from 30 points on the railroad at a volume of 1.5 million bits per day and of processing and delivering the results of a decision at a volume of 0.5 million bits per day.

Thanks to the extensive introduction of computer equipment into the work of the railroad, the computer load is constantly increasing. Thus, since 1974 it has increased from 16 to 20.6 hours per day.

The railroad computer center performs a large variety of tasks, which are grouped in nine subsystems. Among them are the computation of the monthly plan for through and local service freight transport, the computation of normal freight flow routes, the planning of the work of the locomotive brigades of the passenger service, the computation of the monthly technical norms for loading by stations and branches, and many others.

Thanks to efficient computer utilization, the first section of the railroad's ASU, which was not set up and put into operation until the Ninth Five-Year Plan, has furthered the growth of freight shipments, the improvement of operational procedures, and better utilization of rolling stock.

The computer center of the Central Asian Railroad is an example of a collective-use computer center. Its experience demonstrates that it is in such centers that computers can be most efficiently utilized, since there they work with the maximum output and have a work load more than 15 hours per day.

The republic has amassed definite positive experience of collective computer use. There are also computers with efficient work loads in the computer centers of Gosplan and the Uzbek SSR Central Statistical Administration; of the republic's ministries of energy and electrification, geology, and light industry; and of the Tashkent gorispolkom.

But no adequate effort is being made to disseminate this positive experience. The computers of several of the republic's organizations do not have a full work load, and there are instances of their working a total of five to eight hours per day. Computer capacity is not fully utilized, for example, in the computer centers of the republic's ministries of agriculture and agricultural construction even though they could play a more significant role in directing the different sectors of agricultural production and contribute to the improvement of planning.

During the Ninth Five-Year Plan, more than 70 ASUs with varying functions were introduced in the republic. Their efficiency can be increased only if collective-use computer centers are organized. During the first stage this can be done within the framework of a single ministry or department by all subdepartmental enterprises and organizations, as in the computer center of the Central Asian Railroad. The next step in this direction would be the establishment of collective-use computer centers on a territorial basis, which could serve the numerous enterprises and institutions that do not belong to a single department or ministry. During the third stage it is proposed to use data transmission channels to unite all computer centers in a single state computer center network.

A broad program for building collective-use computer centers has been mapped out for the Tenth Five-Year Plan. One of them will be in Tashkent, within the framework of the automated scientific research system worked out by the Cybernetics Institute. Group and territorial collective-use computer centers will be set up in a number of ministries and departments in Nukus, Samarkand, Fergana, and Namangan. The network composed of them will constitute a large step on the road to creating a republic automated control system for the economy.

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CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

GLUSHKOV DISCUSSION OF ARTIFICIAL INTELLECT CONCLUDED

Moscow LITERATURNAYA GAZETA in Russian No 52, 29 Dec 76 p 11

[Conclusion of interview with Academician V. Glushkov by reviewer V. Moyev:
"Artificial Intellect: What Lies in the Future?"]

[Text] We all ponder the future on New Year's Eve. This is probably the way it has always been: People have always peered impatiently into the future from the framework of today. But it was not until now, the era of the scientific-technical revolution, that such "peering" has acquired a serious scientific foundation. Armed with knowledge of the laws of social development and having achieved today's summits of science and technology, man can judge the future with much more substantial grounds than ever before.

At the same time the future of scientific-technical progress has not been predetermined uniquely. The precise direction in which to go and the direction in which to apply effort depend in the end on man himself. Man possesses the fullest possibilities for consciously choosing his future in a socialist society.

Today, our pre-New Year deliberations concern the future of the "manmade twin" of man, creation of which many scientists are prophesying; the future of human dwellings, the way they are envisaged by architectures and designers; and, finally, our "home" in the broad sense--the planet Earth, the fate of future generations.

[Question] Viktor Mikhaylovich, our interview program, as announced in this year's first issue of LITERATURNAYA GAZETA, has reached its last and perhaps most significant part. Last time* you described the progress in building an artificial intellect, and now the final question: What follows after? How will artificial and natural intellect work together, and what sort of relations will exist between them? Between people and robots, if you please.

*See LITERATURNAYA GAZETA, No 44.

[Answer] These questions lead us into the dim future, where not only laymen but also scientists find themselves in a vast world of hypotheses, and sometimes simply guesses.

[Question] Yes, the imagination always follows us wherever we go. There is tremendous interest today in books about the future, and if we readily surrender ourselves to the power of a writer's fantasies, why should we not follow the imagination of a scientist? Moreover the situation is appropriate and pardonable, if your unusual role disturbs you: Once again we meet on New Year's Eve, and our dreams long for flight.

[Answer] OK, then, let's fasten our safety belts, as they say in Aeroflot.

"Hello, I am Your Twin"

[Question]: Where do we begin? In general outline, many believe that artificial intellect will accelerate history tremendously, grace us with miracles of technology, lead people into the Universe, and probably transform dear old Earth into the cozy hearth of mankind. Clearly we cannot envision all of the prospects in a single discussion. Therefore let's try to stick closer to the human personality and its fate. For example, what will intellectual robots be like? Will they be similar to people or not?

[Answer] I must confess that questions of the "form" and "appearance" of robots have not had major emphasis in our plans to date. There is a simple reason for this: For the time being we see no practical need for one sort of "similitude" or another.

[Question] But what if it comes about?

[Answer] You are probably aware of the broad prospects foreseen in development of biology and biochemistry and in production of organic compounds, fabrics, and materials with particular properties. I do not see any fundamental obstacles to science and technology which would prevent us from making organs, body parts, and entire bodies indistinguishable from real ones in the future. We can simulate whatever we like with synthetics--the brightness of joyful eyes, the reddening of cheeks in embarrassment, anxious trembling of the hands. If we want to, we can even make the humanoid creation even better than us.

[Question] Just a second, are you trying to tell me that total similarity is not at all a madman's dream from a technical standpoint? Is it necessary? Judging from all previous technological experience all new creations find their own and, to use the accepted term, adequate form with a delay. At first designers usually imitate something they know. The first diesel locomotives had iron legs suspended from them. Of course this was done not for the purposes of expediency, but simply because form is conservative.

From what I see, if we follow this logic then robots of the future would most likely be humanoid. But there is a difference! A locomotive on stilts is nothing more than funny, but robots outwardly indistinguishable from man are sinister somehow. This is what we perceive, and I think designers have an obligation to make peace with psychology.

[Answer] Doubtlessly. But with which psychology, today's, or that of the future?

[Question] Ah, now I understand. Does this mean that we can see appearance of robots copying our personalities as a likelihood? Will they go about their business on an equal footing with people, fooling us and amusing themselves at our expense?

[Answer] Not at all. Outward similarity is not enough: No matter how robots are going to look, there is no chance that we will give them even a fraction of human rights. These are things, and nothing more. Even if we assume the custom of sending a copy in place of ourselves in certain cases, as we used to do with visiting cards, the robot would most likely be made to introduce himself for what it really is.

[Question] "Hello, I am so-and-so's twin!"?

[Answer] Something like that, but the details have no importance. What is important, however, is to perpetually maintain a distinct legal border between "us" and "them," protecting human interests. Once again what we need is an "emergency cutoff switch," which we had talked about earlier. So that any robot could be neutralized at any moment at human will, so that no robot could even dare bite somebody.

[Question] This is right in line with Isaac Asimov's "laws of robot engineering." Incidentally, what is your opinion of them?

[Answer] Specifically, we can debate the wording, but the way the question is posed and the approach to it are valuable to science. After all, Asimov is a scientist as well as a writer.

[Question] Excuse me, I interrupted you as you were going into the superiority of robots.

[Answer] Unfortunately, nature endows different people differently. Some may have the gift of eloquence, while others may be tight-lipped. One may have perfect pitch, while another may not know C from Q flat minor. Moreover there are some useful attributes which were simply never given to us, while robots can have anything--night vision, a sense of time, or whatever. And it is quite possible that people will also want to possess some such attributes. This could be done, and it would be easier to do if robots are humanoid in general design. This, in a word, is a fully permissible argument in favor of outward similarity. As an example there can be no doubt that concern for the health and physical well-being of people will

elicit broad use of artificial organs to replace natural ones that fail or work improperly.

[Question] We can only thank science for this. It would be very good if science would be able to eradicate mutilations, ills, and physical deficiencies. But there can be no doubt that many have resorted to artificial procedures and operations simply for the sake of beauty, outward appearance. Moreover I would be disheartened most of all on learning that man of the future "builds in" all sorts of mechanisms permitting night vision and other wondrous powers. It is one thing to use special instruments when they are needed, but what about organically modifying the set of capabilities and sense organs? What about losing the fascination of twilight, what about forgetting the concept of silence when ultrasounds and radio waves intrude upon the new ears, what about perpetually counting the minutes? Moreover, what could these future people comprehend of Griboyedov's statement that "happy people do not watch clocks," how could they grasp the majesty of Pushkin's words: "The gloomy cloak of night descended..."? It would be improbable! I think that not only the strengths but also the frailties, all that is mankind is a necessary prerequisite if new generations are to keep in touch with the present, with all history and culture.

But let's ignore even this for the moment. Can you imagine the sort of disorder that would arise? One person would be like a person, another would be a walking radar, and a third would have hands with 40 degrees of freedom. "So what? If I want hooks for hands who says I can't have them?" And, finally, if such borrowing goes far enough, how are we going to define the very border between "us" and "them"? Moreover when outward similarity is total! Try to figure it out, which one is the friend, and which one is totally an electronic prosthesis? Who is to enjoy all human rights, and who is not to?

[Answer] None of these are technical problems. You are talking about ethical rules and rights. At the moment it is difficult to discuss the details and how they might change. I also feel that people will never lose their taste for everything natural, that they will not harden themselves to cultural traditions and the natural beauty of man. But, it stands to reason, much will also depend on the objective conditions and laws of social existence. Who knows, perhaps LITERATURNAYA GAZETA may be carrying on a debate in the third millenium as to whether it is proper to see at night, change the shape of the hands, and the like. To eccentrics with strange pretensions we can respectfully say: Go ahead, change what you want in yourself, but we cannot promise to continue calling you human, and we will not protect you by law.

[Question] In the third millenium, you say? Less than 100 years from now?

[Answer] I am suggesting a hypothesis. If such questions do at all arise--if!--then this will happen very soon, after an artificial intellect is created. I think either in the first century of the next millenium, or never.

About the Center of Consciousness

[Answer] Let's go on. Assuming total outward similarity, how are we going to distinguish what is personality and what is just a shell? No matter how fantastic this problem may appear, it is the one we ponder over the most. Not only in connection with work on artificial intellect but also other pursuits, for example development of organ transplants.

[Question] Recently Professor Robert White, a well known neurosurgeon, declared that he was ready to perform a human head transplant operation. What then?

[Answer] Even if the probability of success is not very great today, the problem remains. What is the human ego? What does it depend upon, where does it "sit," what are the properties of our consciousness? These questions have been bothering me for a long time. Of course we need a serious scientific answer, but we do not have it as yet. I have not even heard of someone somewhere thinking out the appropriate plans, posing the experiments, and so on. Even I myself cannot come up with any sensible ideas about this. For that matter, why look for the answer in cybernetics? The burden lies with the neurophysiologists and the psychologists. And until they speak, as long as the question remains open, we cannot exclude such an alternative.

[Question] There is, we find, fascination in the "closed doors" of science. The closed doors seem to give us the right to build hypotheses and versions.

[Answer] There are two in this case. The first hypothesis: The center of consciousness is inseparably associated with some particular group of living cells; death of our ego is inevitable when they are turned off. If this is so, the question of twins loses its meaning.

The second hypothesis: The consciousness can rest in different regions of the brain, such that by turning off one of its areas or another we would discover them to be interchangeable, and we would find that the center of consciousness is able to move about. Then the hypothesis that it is inseparably associated with a single carrier would collapse. This version is more comfortable to me personally. Why? It seems to me that the sense of ego is associated chiefly with the aggregate of information locked within a particular personality. Sometimes a person becomes disfigured and mutilated to the point of complete unrecognizability. But if his consciousness is not disturbed, people close to him recognize him to be "that same person," and no one else. His order of thinking, memory, and character preclude error. But if a creation appears which is fully a twin in appearance but having another consciousness, this would be a tragedy of hopeless loss of the person, though the physical shell would be entire and unharmed.

I repeat, I tend to think that information is what is most important in the human ego.

[Question] Does this mean that we would be able to create an immortal twin by simply transferring our consciousness into its artificial intellect, scrap the worn body, and live the life of the ease as something new and immortal?

[Answer] Hypotheses must also comply with certain rules of the game. If you recall, I said that given the known methods for transferring information, the "copy" cannot be identical to the "original."

[Question] I even recall your pithy "only if," which you avoided deciphering last time.

[Answer] Since today's conversation borders on the fantastic, I will be glad to do so now.

Giving some freedom to our imagination, we can assume existence of a method for transmitting information differing from traditional methods in which we have to wade through programs, series of instructions, and operations. Assume that science will discover a way for direct "man-machine" communication, a direct relationship between the natural intellect and the manmade, bypassing the sense organs. As a hypothetical example, let us say you sit down in a chair and, as Don Quixote did, place a new "(Mambrin's) 'helmet'" on your head, and the entire thinking process, a complete model of the brain is transmitted directly to the machine with the help of the brain's biocurrents. Of course not the composite biocurrents which we can record on an encephalogram today. These would not be enough. We would have to assume, as an example, that a bank of directed antennas would sound each brain cell individually. We would have to assume that practically instantaneous flow of information would occur in both directions.

From the standpoint of communication quality, direct transmission is best of all, and if we find it to be possible--I emphasize "if" because this is a supposition--then we can recall the hypothesis of mobility of the center of consciousness. A person in conditions fabricated in this way would find himself in truly amazing situations. He would be working, sensing himself to be sitting in a chair and conversing with a machine facing him. Then suddenly he would in a sense see himself from another aspect; he would get the sensation that his absolute twin is sitting in the chair opposite. The sensations may turn out to be changeable: At times he may recognize himself to be in his own chair, and at other times he may sense himself to be in the opposite chair.

[Question] Yes, the plot would appear tempting to science fiction writers. Would you offer it to them?

[Answer] I have already done so.

A Fantastic Plot With a Real Denouement

Once when speaking to some writers I shared this idea with them. And, can you imagine, one of our Ukrainian science fiction writers encountered the plot with artistic form. I think, if I am not mistaken, the book was called "Glaza robota" (The Eyes of a Robot) or something along that line. Without going into its literary merits, I can say that the plot involved a person who was working with a machine endowed with an artificial intellect, mastering movement of his center of consciousness and learning to control it. He could transmit his consciousness to the machine at will, return it to himself, and then send it back to the machine and keep it there. This means that the human ego continues to live in the machine without experiencing the least trauma, without any sort of break in its continuity: You would not feel that you have stepped over the threshold of your death and started some sort of new "life." The latter is especially important.

[Question] Permit me to join you in this fantasy. Assume I transferred my consciousness to the machine, gained immortality, and felt nothing myself. But others would feel something! What would happen, for example, with the poor body which remains in the opposite chair as if nothing had happened? Having no ego, what is the body to do after its soul vanishes and is faded to a pitiful existence? What sort of phantom would this be in general--an entirely unimaginable form of being, a thing of body and blood, but nevertheless devoid of consciousness?

[Answer] Questions, questions. I can see that there is a limit beyond which it would be better to let artistic fantasy continue alone. I think it is time for us to return to reality.

[Question] All right. I do have another question about the usefulness of fantasy. In literature, the science fiction writer cannot do without realities, be they even conditional. This is understandable. However, I can see from today's discussion that the scientist also toys with fantasies in his imagination, though he recognizes their whimsical nature quite well. Why do you do this? As a way to relax, to take a break from the strict logic of your work? Or does imaginative thinking benefit the scientist on its own?

[Answer] Yes, I think it does. Of course a hypothesis must be treated carefully because it is only the first look, the first approach to the problem; it is not a solution to the problem, but only a way of posing it. For precisely this reason a scientist cannot move forward without hypotheses, more or less concrete ones depending on the person's scientific specialty. He who stops hypothesizing is no longer of use to science. Naturally, some of the suppositions subsequently break down; such is their fate, but this does not deprive hypotheses of a positive role. We also gain knowledge when we disprove a hypothesis.

Let's go into specifics. It appears to me that at least one pressing problem is posed to science by today's discussion. Can you guess what it is?

What is consciousness? What are its properties? Where is its seat? Can this seat move? No matter what the answer turns out to be, it will be needed by science. Even if it breaks down the foundation of some fantasies, it will at least strengthen the reliability of our predictions of the future.

[Question] Shall we end our talk with this? Though before we do so I have one more request. Time is passing quickly. There is little time left until the end of the century and, consequently, until the "test of maturity" of the artificial intellect, as you put it. You told me that a commission will convene to determine what it is behind the wall, in the adjacent room, be it man or machine. Would you promise to allow "us," from the LITERATURNAYA GAZETA of the future, to participate in the discussion?

[Answer] Yes, time is passing quickly, and that is the crux of the entire matter. If I am to be the one to do the inviting, I promise.

[Question] Thank you very much.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

SCIENCE HELPS IN IMPLEMENTATION OF FIVE-YEAR PLAN

Kiev PRAVDA UKRAINY in Russian 8 Jan 77 p 3

[Article: "Science Serves the Five-Year Plan"]

[Text] The Tenth Five-Year Plan, a five-year plan of effectiveness and quality, is striding confidently throughout the country. Workers of our republic, like all Soviet people, inspired by the historic decisions of the 25th CPSU Congress, the October (1976) Plenum of the CPSU Central Committee and the brilliant, profound speech at the Plenum by General Secretary of the CPSU Central Committee Comrade L. I. Brezhnev, are successfully implementing the immense program for communist construction. Scientists of the republic are making a large contribution to its implementation. The high evaluation of the fruitful creative work of the Ukrainian SSR Academy of Sciences for increasing the effectiveness of scientific research and accelerating the introduction of its results into the national economy, which was given by Leonid Il'ich Brezhnev in his speech at the October Plenum, stimulated another influx of creative energy and a fervent desire on the part of scientists to multiply what has been achieved and to take new steps in the acceleration of scientific and technical progress.

Collectives of institutions of the Ukrainian SSR Academy of Sciences have successfully completed the fulfillment of planned assignments and socialist commitments for the first year of the five-year plan. Important research was done which is of great significance for the development of science and further growth of the country's economy. This made it possible to introduce into the national economy a number of developments with an annual economic effect of 227.6 million rubles.

The Institute of Electric Welding imeni Ye. O. Paton is a true promoter of scientific and technical progress. The creative cooperation of scientists of this scientific and technical complex with other research institutions and industrial enterprises produced an appreciable return. A new technological process for manufacturing turbine rotors was developed and introduced

at the Khar'kov Turbine Plant. It provides for high quality and reliability of power aggregates. Its application has already produced a savings in the amount of 4.9 million rubles.

The Institute of Problems in the Study of Materials made a significant contribution to the Ukrainian SSR Academy of Sciences' fulfillment of socialist commitments for the first year of the Tenth Five-Year Plan. It introduced into production special pastes for treating highly durable metals and alloys. This development made it possible for the national economy to save 9.8 million rubles.

As we know, in the current stage of scientific and technical progress, a special role is played by extensive application of the results of the fundamental sciences -- physics, mathematics, chemistry, biochemistry, microbiology and others. As a result of the fruitful cooperation of the Institute of Cybernetics of the Ukrainian SSR Academy of Sciences and the Leningrad Svetlana Association, the first domestic universal microelectronic computer was created. Extensive use of it in the country's national economy produced a savings of 44.6 million rubles.

Important scientific achievements were also made by academic institutions of the republic: institutes for problems of strength of materials, physical and technical properties of materials at low temperatures, metal physics and technical thermophysics, the Donetsk Technical Physics Institute, the Institute of Physical Chemistry imeni L. V. Pisarzhevskiy, botany institutes, geotechnical mechanics institutes and others.

Scientists of the republic rendered an appreciable amount of assistance to rural workers. Farms of Kiev, Zhitomirskaya, Ternopol'skaya and other oblasts extensively utilized a preparation that provides for additional weight gain when fattening cattle -- karobksilin. It was created by the Institute of Biochemistry imeni A. V. Palladin in cooperation with the Ukrainian SSR ministries of the food industry and agriculture. New methods of selecting high-protein forms of wheat were suggested by the collectives of the institute for plant physiology and nuclear research in conjunction with the Mironovka Scientific Research Institute of Wheat Selection and Seed Growing.

Scholars of the social science section of the Ukrainian SSR Academy of Sciences have concentrated their efforts on comprehensive development of such crucial problems as the patterns of development of the national economic complex of the USSR, philosophical-sociological problems of the scientific and technical revolution, typical features and peculiarities of a developed socialist society, the establishment of a new historic community of people, the Soviet people, and criticism of anti-Marxist socioeconomic ideas. A number of theoretical works and scholarly collections on important socioeconomic issues in light of the decisions of the 25th CPSU Congress were prepared for publication ahead of schedule.

At the start of the second year of the Tenth Five-Year Plan, scientists of the republic are bursting with creative energy and a fervent desire to be in the vanguard of communist construction and to contribute their bit of labor to the nationwide cause. Collectives of the institutes of the Ukrainian SSR Academy of Sciences, preparing a worthy greeting for the 60th anniversary of Great October, are earmarking new goals and, for 1977, they are taking on increased socialist commitments for a further rise in the effectiveness of scientific research and acceleration of the introduction of completed developments into the national economy.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

WAYS TO IMPROVE VUZ RESEARCH WORK

Moscow EKONOMICHESKAYA GAZETA in Russian No 52, Dec 76 p 17

[Article by V. Grigor'yev, rector of MEI; I. Orlov, director of the division of scientific-research work MEI: "Making Fuller Use of the Scientific Resources of VUZ's"]

[Text] Scientific work in higher education plays a substantial role in improving the quality of specialist training and teacher qualification. At the same time, it is an important form of utilizing the scientific potential to speed up scientific-technical progress, because more than one third of the scientific workers of the country are working in the VUZ's. The article below discusses ways to improve the effectiveness of VUZ science.

Scientific research has its own characteristics in VUZ's. The combined work of specialists of different profiles creates favorable preconditions for carrying out complex integrated research and for solving scientific problems at the "interface" of the sciences. A very important advantage of VUZ scientific work is the relatively lower costs of carrying out scientific research.

The MEI [Moscow Power Engineering Institute] has accumulated considerable experience in the organization of scientific research; it has an excellent base for further expansion. More than 1,800 teachers of the institute and its branches are participating in scientific work, including 1,000 doctors and candidates of science and, in addition, more than 500 graduate students and more than 9,000 undergraduates. During the Ninth Five-Year Plan the economic effect from adopting the results of research came to an average of three rubles for every ruble spent. For inventions by its scientists the institute has received 593 certificates of invention and 140 patent certificates from foreign countries. Three projects have been awarded the State Prize. The institute's scientists have published 205 text books, study aids, and monographs, 4,900 articles; they have defended 440 candidate's and 32 doctor's dissertations.

We should like to mention that these quantitative indicators by no means completely characterize the quality of the VUZ scientific efforts. For this reason, today one of the most urgent problems is to work out criteria for evaluating the quality of scientific work.

An analysis of the factors determining the effectiveness of scientific research shows that success in the long run depends on the level of organization, planning, and management. Consequently, in this sphere as well it is necessary to learn to endeavor more efficiently to improve effectiveness--that is, to solve the task which was singled out especially by L. I. Brezhnev at the October 1976 Plenum of the CC CPSU.

The effectiveness of scientific research is largely determined already at the planning stage. It seems that at the present time there is an incorrect tilt--that is, for the key VUZ's--in favor of narrowly-practical and at times simply petty applied research at the expense of theoretical, fundamental research.

In order to select scientific-research projects of greatest interest to the national economy, we in the institute have introduced a procedure of drawing up pre-contract technical-economic substantiations with respect to cost-accounting themes. In doing so we evaluate the freshness of the project, the expected benefits, and the conditions of adoption.

In concentrating the efforts of the scientists and scientific schools of the VUZ's on resolving vital national economy integrated problems and increasing the proportion of fundamental research in higher education, a vital role must be played by centralized planning.

Today in the MEI more than half of all projects are carried out in accordance with the plans of the USSR Council of Ministers State Committee on Science and Technology and the USSR Academy of Sciences. But these projects are introduced into the plans primarily at the initiative of the leading scientists of the institutes themselves, and the level of coordination of the research is still inadequate. For this reason it is not always possible to concentrate scientific efforts on the implementation of integrated tasks; this substantially reduces the overall yield. Frequently projects are carried out which are random in character, which handle necessary but at the same time rather specific and narrow tasks which are entirely within the capabilities of scientifically less high-powered collectives. For purposes of eliminating these negative factors it is probably necessary to increase the role of the USSR Ministry of Higher and Secondary Specialized Education in the planning and coordination of VUZ scientific efforts.

An important way to improve the effectiveness of VUZ science is to improve the organization of work to adopt the results of research in the national economy. The most acute need here is to work out and implement centralized measures.

In formulating coordination plans approved by the USSR State Committee on Science and Technology, in our opinion, it is essential to establish beforehand the specific participation and duties of the VUZ's, sector scientific-research institutes, and industrial enterprises in the adoption of the results of research. After all, a VUZ--for reasons independent of it--is not very often able to effect the utilization of this idea in the national economy. And this situation leads to undesirable consequences. Thus, it took about 20 years to realize a new idea proposed by MEI scientists for a highly-effective system of diagonal hydraulic turbines.

One of the factors tending to slow down the adoption of the VUZ's scientific research projects is that they are not fully complete in terms of economic substantiation and design appraisal. Economic calculations, in our opinion, should be carried out during the research itself, because their main purpose is to serve as criteria and a means of optimizing technical solutions. The organic inclusion of economic calculations in the fabric of technical research will undoubtedly help to improve the effectiveness of the results.

It is obviously advisable for the leading VUZ's to have even small laboratories which can be engaged in determining the effectiveness of scientific-research work.

The effectiveness of scientific research to a large extent depends as well on this material-technical support. Even now, a large institute such as the MEI, which performs a large amount of scientific-research work, is not always in a position to acquire essential equipment. For this reason, converting to the practice of supplying VUZ science efforts centrally will make it possible to substantially speed up scientific research efforts and to improve their quality.

And, last but not least, improving the effectiveness of VUZ scientific efforts requires organizational measures aimed at improving the administration system. In the leading VUZ's these problems are handled by the divisions of scientific-research work. But this form of organization of the management of multi-level, multi-sector scientific subdivisions is no longer appropriate to the contemporary higher level of standards. For example, the MEI's division of scientific research carries out state budget and cost-accounting work in the amount of more than 15 million rubles per year. This is substantially higher than the volume of research of many sector scientific-research institutes. For purposes of improving the organization of scientific efforts in the VUZ's it would be advisable to create a new level of scientific administration within the structure of the USSR Ministry of Higher and Secondary Specialized Education.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

PROBLEMS IN COORDINATING VUZ, RESEARCH INSTITUTE EFFORTS

Moscow EKONOMICHESKAYA GAZETA in Russian No 52, Dec 76 p 17

[Article by V. Vornin, rector of the Blagoveshchenskiy Agriculture Institute: "Coordinating the Work of VUZ's and Scientific Institutes"]

[Text] The problem of selecting and training scientific cadres and improving the quality of training of future specialists, in our opinion, could be resolved considerably more successfully if the leading scientists of the scientific-research institutes would take active part in VUZ instruction. In this way, it becomes possible for the scientific-research institute to check the correctness of the selection of the future staff member during his training period, to purposively influence the level and nature of his scientific training. After all, determining the suitability of one who intends to work in a given scientific-research institute by documents alone is not an easy task. Frequently the process of adaptation of new staff members is a lengthy one. From this standpoint, in our opinion, it is advisable to create scientific-training associations. It is especially important to create such associations where there are few scientific cadres and fragmentation is appreciable.

Consider, for example, scientific institutions dealing with agricultural problems in the Far East. There are few such institutions in the region, and their staffs are small. There are two scientific-research institutes in Amurskaya Oblast: the All-Union Soy Institute and the Far Eastern Veterinary Institute. The one has 80 engineering-science staff members; the other has 32. Meanwhile, in our VUZ there are 267 teachers, 39 graduate students, 38 scientific staff members, and about 2,000 undergraduates engaged in scientific research. We have almost eight times more candidates of science than the Soy Institute does.

Like other VUZ's in the country we are striving to see to it that the student engages systematically in scientific work; we ascribe great importance to practical production work. The instructors utilize it in order to instill a creative attitude toward one's work; they help in collecting materials for course and diploma work. And yet, students' practical work in the scientific-research institutes does not always yield the expected result. A particular factor in this is the fact that the instructor does not have a direct interest in improving the student's qualifications; frequently he doesn't have the time either.

The separate operations of the scientific research institute and the VUZ make it difficult to have year-round participation of the students in research carried out by the institute. The results of research carried out in the institute are by no means always known to the students.

I should also like to touch upon the problem of VUZ specialization. It has been found that the most economically effective department is one with an enrollement of 250 to 300 students. With small departments it is difficult to provide the subdepartments with instructors. Small-scale departments are inconvenient in many other ways as well. There are two agriculture institutes in the Far East: the Primorskiy and the Blagoveshchenskiy. Each of them have agronomy departments with 75 students enrolled. Both VUZ's are training economic organizers and bookkeeping specialists, and in this case as well only 75 students are enrolling every year.

VUZ specialization and department enlargement constitute one way to improve the quality of training of high-qualification cadres.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

ROLE OF PLANNING, COOPERATION IN VUZ RESEARCH WORK

Moscow EKONOMICHESKAYA GAZETA in Russian No 2, Jan 77 p 10

[Article by V. Krutov, member of the board, USSR Ministry of Higher and Secondary Specialized Education: "Reserves of VUZ Science"]

[Text] A remarkable feature of the development of higher education at the present stage is the broad expansion of scientific research. In 856 VUZ's of the country there are about 428,000 scientific-pedagogical workers, including 15,600 doctors and 153,300 candidates of science. Many VUZ's have become a kind of scientific-training center in which along with the training of highly-qualified specialists there is ongoing research which makes a substantial contribution toward the resolution of urgent theoretical problems in various sectors of knowledge, as well as problems of an applied nature.

The overall volume of expenditures on scientific research in the institutes and universities of the USSR Ministry of Higher and Secondary Specialized Education approaches 900 million rubles. More than 80 percent of the work is done on the basis of economic agreements on direct requests from enterprises. The use of the results of many investigations in the national economy yields a substantial economic effect.

Also indicative of the effectiveness of the research carried out is the fact that in 1971 through 1975 143 VUZ scientists were awarded the Lenin Prize and the State Prize; 51 scientists were awarded Komsomol Prizes. Many projects have been awarded prizes of the USSR Academy of Sciences and diplomas and medals of the VDNKh [Exhibition of Achievements of the National Economy USSR].

But this alone does not determine the effectiveness of VUZ scientific work. One of the substantial results is the publication of textbooks and manuals, monographs, the preparation of new courses of study, the training of scientific cadres, and, especially, the recruiting of young students for scientific research.

The links between VUZ scientific work and production are expanding year by year. Cooperation is also expanding between the VUZ's and the scientific institutions of the USSR Academy of Sciences, the academies of sciences of the union republics, and sector ministries and departments. There is an increased number of VUZ's whose scientists are engaging in working out vital scientific and scientific-technical problems stipulated by national economy plans, the plans of the USSR Council of Ministers State Committee on Science and Technology, and the USSR Academy of Sciences. The number of such themes in 1976 exceeded 10,000.

In the period 1971 through 1975 more than 130 problematic and sector laboratories were set up; the North Caucasus Scientific Center of Higher Education expanded its activity. Also of demonstrated effectiveness are new forms of contact between VUZ's and industrial enterprises on the basis of long-term integrated agreements of cooperation, the creation of integrated research crews, the organization of production-training associations on a voluntary basis. Excellent results have come from cooperation between the Moscow State University and the ZIL [Moscow Motor Vehicle Plant imeni I. A. Likhachev] Association, the Leningrad Polytechnical Institute and the Elektrosila Association, the Belorussian Polytechnical Institute and the Minsk Tractor Plant and the Minsk Motor Vehicle Plant, the Chernovtsy State University and a number of enterprises in the oblast.

At the same time, there are many unutilized reserves available in the organization of scientific research in the VUZ's. There are still too many petty themes being researched, themes which are of no great scientific or practical importance; there is still considerable unjustified duplication; research investigations in the fundamental sciences is not developing adequately; a considerable number of the instructors are not taking part in the project.

An important factor in the more complete utilization of the scientific potential of higher education for purposes of resolving urgent tasks is-- planning. It is advisable to bring the planning of VUZ scientific research into conformity with the country's existing system of state, sector, and republic plans of scientific-research work. It is also obviously necessary to enhance the role of the ministries to which VUZ's are subordinated in planning scientific-research work. Existing experience indicates the importance of the program-goal method of research planning, a method which is not yet being adequately utilized. The VUZ's themselves can do a great deal. For purposes of concentrating the efforts of VUZ scientists in resolving integrated scientific-technical problems it is essential for each VUZ to determine the basic directions of further development of its scientific research.

Of considerable importance for the rational utilization of state resources are the various forms of inter-VUZ cooperation in carrying out research. The joint utilization of scientific instruments and costly equipment, the creation of inter-VUZ computer centers, science libraries, design bureaus, and experimental-production bases is making it possible to substantially reduce the time and costs of carrying out projects.

The USSR Ministry of Higher and Secondary Specialized Education hopes that the discussion launched by this newspaper concerning the task of improving the effectiveness of VUZ scientific efforts (issue No 52 1976) will be participated in by scientists and all those who are involved in organizing it, expressing valuable proposals on the utilization of existing reserves.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

PREPARATORY COURSES FOR VUZ ENTRANCE COMPETITIVE EXAMINATIONS

Moscow PRAVDA in Russian 21 Dec 76 p 3

[Article by M. Mayatskiy, director of preparatory courses at Leningrad Electrical Engineering Institute: "Preparing for the Competitive Examination (Selection of a Profession)"]

[Text] Preparation for entrance into an institute begins long before the doors of VUZ entrance commissions open. Hundreds of thousands of young men and women are now pondering: what profession should I select? The higher educational institutions are beginning a wide-ranging search for "their" students.

At this time vital contacts of future secondary-school graduates with VUZ instructors are particularly precious. For it is they who have seen in their time many happy and unsuccessful student destinies and who know best of all what qualities must be possessed to become an able specialist. An older friend can intimate tactfully and in time: would not the young man be making a mistake in the choice of his vocation? Or, on the other hand, to turn regular school knowledge into that direction which would open up an enticing quest for unexpected, original decisions. In a word, much depends on a direct meeting of "interested parties" in the success of the coming enrollment into higher educational institutions.

This is one of the reasons for the big popularity of preparatory courses at higher educational institutions. In Leningrad alone, more than 70,000 students prepare themselves in an organized manner for the competitive examinations. Every second future student now undergoes this form of study.

At our electrical engineering institute more than 5,000 persons are studying at correspondence, evening and shift preparatory courses. These are young workers, graduates of ten-year city schools, fighting men of the Soviet Army transferred to the reserve, rural youth. Usually of the total number enrolled at the institute more than 70 percent constitute our trainees.

It would seem as if everything were normal. The students turn into pretty well trained lads, knowing their calling and soberly selecting their profession. But with the end of the first semester, the first session takes place and a count is made of losses. Unfortunately, among those discharged for failing, there are many of those who underwent the preliminary training.

This means that far from everything is done to help young people not only to pass the competitive examinations but also to handle successfully the study regime new to them. On analyzing the established practice, the instructors came to the conclusion that it was necessary to seek new teaching forms. For example, for a long time course studies were conducted along the lines of school lessons. Moreover, as confirmed by practice, failure to adapt to the VUZ system of instruction constitutes one of the chief reasons for the elimination of students in the early courses.

Four years ago we started to introduce certain forms of teaching specifically for VUZ's. Theoretical materials are now presented in a series of lectures. Examples and problems are solved at special practical classes. This puts the trainee in the position of a student. Naturally at such classes, only the very hard problems are brought up which are difficult to solve independently. Furthermore, there are held introductory, adjusting, survey and repeat-summary lectures.

The lads are taught to make synopses and are inculcated habits of independent work with textbooks. The institute puts out "Metodicheskiye Ukazaniya" [Methodic Instructions] and "Domashniye Zadaniya" [Homework Assignments] on mathematics, physics, Russian language and literature, as well as the collections "Metodicheskiye Ukazaniya k Resheniyu Konkursnykh Zadach" [Methodic Instructions for the Solution of Competitive-Examination Problems] on mathematics and physics, which are given to every attendee.

Psychological preparation of young people for competitive examinations is of great importance. We try to create an atmosphere approximating entrance tests at the time of the concluding control work (including the issue of title pages, inserts and the like). Thus last year almost two thousand attendees took part in the final classes on mathematics.

We should also be thinking of how to activate the work of correspondence preparatory courses. Something has already been undertaken in this direction. For example, for those doing the control assignments, unique attended "sessions" are organized, in the course of which survey lectures are read and exercises are conducted for all parts of the examination programs.

The effectiveness of the preparatory courses would be significantly greater if the institute departments participated better in our work. At times the impression is created that although you may be dealing with "relatives," they are to say the least very remote ones. The instructors assigned by the departments for methodic assistance to those preparing for entrance into the

institute are loaded with their own teaching jobs, while the work at the classes is not included in their pedagogic load. Nor do departments consider frequently questions of teaching methods or the selection of highly qualified instructors.

I think that guidance and control of the teaching process by the leading departments should be done on a wider basis. After all they are in a position to judge most accurately concerning defects in the preparation of each new contingent for the VUZ and later frequently spend much energy in weeding them out. Why not then do this in time?

Wide use is made of teaching technical aids at the courses. The institute has assigned the necessary equipment and an extra staff of motion-picture operators and laboratory workers. The course collective is working on the creation of slides, film reels, transparencies.

The Organizational-Methodic Council of Leningrad VUZ's created in our city could provide significant assistance to the preparatory courses. It is for the purpose of generalizing and disseminating advanced experience and strengthening interinstitute ties. We hope that the council of rectors and the city entrance commission will be giving more attention to the courses.

It cannot be considered normal that there has not been created so far a single set of model regulations on preparatory courses for higher educational institutions. As a result, you find differences in the salaries of instructors, in determination of staffs and so on. The USSR Ministry of Higher and Secondary Specialized Education should administer the system of preparatory courses in a more organized and purposeful way. This would contribute to the solution of many vexing problems.

The next competitive examination is not distant. The secondary school graduates with whom we are working and whom we are preparing for future student life will come to take the examinations. Has everything been done for them? Will they be able to survive the serious competition for higher school? These questions are troubling us, the instructors of the preparatory courses, today.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

DECEMBER MEETING OF GEORGIAN SSR ACADEMY OF SCIENCES

Tbilisi ZARYA VOSTOKA in Russian 9 Dec 76 p 2

[Article: "The Lofty Duty of Scientists (General Meeting of the Georgian SSR Academy of Sciences)"]

[Text] The Communist Party expects of scientists increasingly penetrative investigation of new processes and phenomena, an active contribution to scientific-technical progress, serious, penetrating, bold research, reasoned analysis of arising problems, responsible recommendations on the most feasible ways of solving them for the sake of unceasing improvement of the life of workers, for the sake of building a communist society.

In his speech at the October (1976) Plenum of the CC CPSU Comrade L.I. Brezhnev emphasized once more the need of further strengthening the tie of science to production.

The general meeting of the republic's Academy of Sciences held 6 December was devoted to the tasks of the Georgian SSR Academy of Sciences stemming from the decree of the CC CPSU on the Georgian party organizations, the decisions of the October (1976) Plenum of the CC CPSU, the 3rd and 4th plenums of the Georgian Communist Party CC; taking part in it were directors, secretaries of party organizations, chairmen of local committees, chairmen of councils of young scientists of scientific-research institutes.

Vice President of the republic's Academy of Sciences, Academician of the Georgian Academy of Sciences Ye. Kharadze presented a report.

Academicians of the Georgian Academy of Sciences made speeches at the meeting-- Vice President of the Georgian SSR Academy of Sciences A. Prangishvili, Academician-Secretary of the Division of Chemistry and Chemical Technology G. Tsi-tsishvili, Academician-Secretary of the Earth Sciences Division F. Davitaya, Academician-Secretary of the Division of Applied Mechanics and Control Processes V. Makhaldiani, Academician-Secretary of the Division of Language and Literature Sh. Dzidziguri, Academician-Secretary of the Division of Biology L. Gabuniya, Director of the Computing Center of the republic's Academy of

Sciences, Doctor of Physico-Mathematical Sciences D. Kveseleva, Acting Director of the Institute of Economics and Law of the Georgian Academy of Sciences, Corresponding Member of the republic's Academy of Sciences A. Guniya, Acting Academician-Secretary of the Division for Problems of Agricultural Sciences, Corresponding Member of the republic's Academy of Sciences M. Daraseliya, Director of the Institute of Physiology imeni I. Beritashvili of the Georgian SSR Academy of Sciences, Corresponding Member of the Georgian Academy of Sciences T. Oniani, Director of the Institute of Mining Mechanics imeni G. Tsulukidze of the republic's Academy of Sciences, Doctor of Technical Sciences E. Mindeli, Head of a department of the Institute of Philosophy of the Georgian Academy of Sciences, Doctor of Philosophic Sciences G. Bandzeladze, Head of a department of the Institute of Construction Mechanics and Seismic Stability of the Georgian SSR Academy of Sciences, Corresponding Member of the republic's Academy of Sciences Sh. Napetvaridze, Secretary of the Party Bureau of the Institute of History, Archeology and Ethnography imeni I. Dzhevakhishvili of the Georgian Academy of Sciences Doctor of Historical Sciences G. Margiani, Chairman of the local committee of the Institute of Metallurgy imeni 50-Letiye SSSR of the republic's Academy of Sciences, Candidate of Technical Sciences K. Gelashvili.

With each year the contribution of Georgia's scientists to the solution of important agricultural problems is bigger. At the present time exceptionally favorable conditions exist for the development of science. Basic research in the field of the natural and social sciences is being directed on an increasing scale to the comprehensive solution of the most important scientific-technical and social problems.

Undoubtedly there are achievements, but ahead lies much strenuous work. The June (1976) decree of the CC CPSU, decisions of the October (1976) of the Plenum of the CC CPSU, the 3rd and 4th plenums of the Georgian Communist Party CC present to scientists and all creative collectives in the republic new important tasks for speeding up more scientific-technical progress. The 3rd plenum of the Georgian Communist Party CC brought up the task of more rapid development of the republic's productive forces as being one of the chief tasks facing Georgian scientists on the basis of rational utilization of its rich natural, soil and climatic conditions, material and manpower resources, a large scientific potential and all internal reserves and possibilities.

The directors and party organizations of scientific institutions are called upon to be more determined in achieving greater effectiveness of research, rapid and fruit utilization of their results in the national economy. The way to this lies in passing scientific developments to producers in a state of maximum readiness.

Unfortunately, the opinion has not yet been eliminated that the job of scientists is just to achieve valuable scientific-technical results, but their practical utilization should be the concern of production people. Such a statement of the problem is basically incorrect and contradicts the demands of the times. The civil duty of the scientist is to be a champion of scientific-technical progress not just in his office or laboratory but outside of them as well.

In the speeches, the need was pointed out for strengthening the struggle against conservatism, stagnation and slavery to routine. It must assume an aggressive character, be concrete, purposeful, objective.

The speakers said that a task of the first order of scientific institutions is to intensify their work for the purpose of speeding up scientific-technical progress and increasing production processes. At the same time, the main attention should go to the introduction of scientific achievements and innovations, advanced experience and progressive technology.

At the October Plenum of the CC CPSU Comrade L.I. Brezhnev approved the work of complexes uniting scientific-research institutes and industrial enterprises, created by the Ukrainian Academy of Sciences with the active assistance of the republic's party organizations and the experience of cooperation of scientific-research institutes and design bureaus of Moscow with industrial enterprises in the capital.

It was emphasized at the session that the study and introduction of the practice of the scientists in the Ukraine and Moscow would undoubtedly be useful for Georgia's economy.

In the attainment of the gains set by the party before the scientists of the republic, important significance is to be attached to greater strengthening of party, state, production and labor discipline, to an uncompromising struggle with any displays of survivals of the past. It will be necessary, it was noted in the speeches, to disseminate in all scientific institutions and subdivisions the patriotic initiative of the Rustavi metallurgists as it is aimed at the achievement of the main task of the Tenth Five-Year Plan--higher quality and efficiency.

The participants of the general meeting of the republic's Academy of Sciences assured the party and the government that the scientists of Georgia will apply all their energies and knowledge to the fulfillment of the responsible tasks set before Georgian science by the 25th CPSU and brought forward by the October (1976) Plenum of the CC CPSU, the historic decree of the CC CPSU concerning the Georgian party organization and the decisions of the subsequent plenums of the Georgian Communist Party CC.

The general meeting of the Georgian SSR Academy of Sciences adopted a corresponding decree and approved the plan of basic scientific-research measures.

Head of the Department of Science and Educational Institutions of the Georgian Communist Party CC E. Sekhniashvili took part in the work of the general meeting of the Georgian SSR Academy of Sciences.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

BELORUSSIAN STATE PRIZES

Minsk SOVETSKAYA BELORUSSIA in Russian 4 Jan 77 p 3

[Article by N. Borisevich, Chairman of the Committee on BSSR State Prizes in Science and Technology and President of AS BSSR: "Laureates of the BSSR State Prize--On the Advanced Frontiers of Science and Technology"]

[Text] It is common knowledge that science and progress in technology have today become the basis of the effectiveness of national production and the growth of its quality indicators. The characteristic feature of the work projects which gained the BSSR State Prizes in science and technology is their great significance both from a fundamental standpoint and in resolving concrete national economy problems.

Cited for a prize was the series of papers by Academician of AS BSSR B. I. Stepanov and Doctors of Physicomathematical Sciences V. P. Gribkovskiy, A. S. Rubanov and A. M. Samson under the title "Development of Methods of Calculating the Energy and Intermittent Characteristics of Solid-State Lasers." The authors determined from a theoretical standpoint the relationships between the optical, spectroscopic and thermophysical properties of an active substance, the conditions for its excitation and the parameters of the resonator on the one hand and the basic characteristics of the generated radiation on the other. They also studied the interaction between a powerful laser emission and a substance. Their research paved the way for the development of simple and effective methods of rating solid-state lasers, methods which are widely used in practice.

Academician of AS BSSR N. S. Akulov, Corresponding Member of AS BSSR N. N. Zatsepin and Candidate of Physicomathematical Sciences M. A. Mel'guya developed and introduced into production electromagnetic methods and means of nondestructive checking of the mechanical properties of ferromagnetic materials. The properties of steels are usually determined through the use of hardness gages, tensile-testing machines and microscopes by the manufacture of special models; this entails high labor consumption and low productivity and does not provide full control over the quality of the products.

The authors suggested methods which enable the workers to exercise control over the quality of the sheet steel right in the production process and to do this rapidly and without great labor expenditures. For the practical application of these methods they developed special instruments which proved to be highly effective. These are in successful operation in the Magnitogorsk, Karaganda, Novosibirsk and Zaporozh'ye metallurgical enterprises and in the Minsk tractor and Moscow pipe plants.

The honorary title of Laureates of the BSSR State Prize was conferred upon the collective of scientists which worked for many years under the direction of Academician of AS BSSR N. D. Nesterovich in the conduct of experimental research on the morphological, biological and physiological properties of arboreal plants. The results of the experiments were set forth in six monographs. It was our country's first instance of this kind of fundamental research; it is the basis for the preparation of measures for further enrichment of the republic's flora and for increasing the productivity of the forests. The monographs of these authors are being used as textbooks in the training of specialists in forestry and wood decorative art.

Of great importance for increasing the yield of the republic's fields is the soil research carried out by a group of Belorussian scientists which includes Academician of AS BSSR P. P. Rogovoy, Academician of VASKhNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin] T. N. Kulakovskaya, Corresponding Members of AS BSSR S. N. Ivanov and A. G. Medvedev, Candidate of Agricultural Sciences N. I. Smeyan and others. They studied the characteristics of the natural conditions which affect the development of the soil formation processes in the territory of Belorussia; they provided a description of the chief characteristics of each type of soil; they worked out the theoretical bases for the classification, geographic and agricultural production districting and the mapping and qualitative evaluation of the soils; and they demonstrated the relationship between the size of the yield of agricultural crops and their agrochemical properties.

The publication of the 12-volume Belorussian Soviet Encyclopedia [BelSE] was an event of great scientific importance in the history of the Belorussian people. In a comparatively brief period the editorial collective brief period the editorial collective under the supervision of Academician of AS BSSR P. U. Brovka carried out an enormous scientific and editing job. The general reader obtained a source of information on social and political life, the history of the peoples of the world from ancient times to our days and the development of science, technology and culture in our country and abroad. The encyclopedia provides a profound and comprehensive description of the historic successes of the Soviet Union in the building of communism, the all-embracing activity of the CPSU, and the history and present-day development of the international communist, working-class and national liberation movement.

Of the 35,000 articles in the BelSE nearly half deal with Belorussian subjects, thus providing a medium for a delineation of the most important

events and phenomena in the life of the Belorussian people. Extensive coverage is given to the successes of the republic in all the areas of political, economic and cultural life, successes achieved in the fraternal family of the nations of USSR.

Also cited for the State Prize were a number of works which resolve urgent problems of technical progress in industrial and agricultural production.

High honors were bestowed upon the collective of Minsk tractor builders which includes specialists of the enterprise P. I. Boykov, A. P. Kozlov, V. I. Kharitonovich and others; they developed the designs and organized the production of the all-purpose MTZ-80 tractor and 11 of its various purpose modifications. The new model tractor was awarded the Badge of Quality and at exhibitions it won five gold medals and a certificate, first class. The workers who developed it received 14 invention authors' certificates. For a number of indicators the new machine surpassed the comparable foreign models.

V. N. Kopylov, G. M. Kazakov, Ye. F. Bykov and other specialists of the Gornel' Machine-Tool Building Plant imeni S. M. Kirov and the Minsk branch of the State Planning, Technological and Experimental Institute Orgstanki-prom developed a new series of hydrolyzed transverse planing machines of a high quality category. The enterprise's output is competing successfully in the international market and is being exported to 58 countries, including FRG, Italy, France and Japan. The yearly economic effect achieved by putting the transverse planing machines into production amounted to approximately 12 million rubles.

A prize was awarded for the work of a group of specialists of the production and technical association Integral, a group consisting of A. N. Zharov, A. D. Kiselev, V. A. Zen'kovich, A. P. Rydzhevskiy and others. These authors developed a complex multipurpose technological process appearing for the first time in the Soviet Union and they created a set of highly productive equipment. Labor productivity on the basic operations was increased by 50 to 100 percent and expenditure of scarce materials was more than halved. The economic effect resulting from the introduction of the innovation amounted to approximately 40 million rubles. The work earned two gold medals at international exhibitions in Brno and Leipzig.

The BSSR State Prize was also awarded for the work of the specialists of the Grodno production association Azot imeni S. O. Pritytskiy and the scientists of the Belorussian Technological Institute imeni S. M. Kirov. This creative group, consisting of G. I. Solov'yev, I. M. Plekhov, A. I. Yershov and others, suggested a new design for direct-flow centrifugal apparatuses. The use of these resulted in a more simplified and economical technology for obtaining caprolactam and nitrogen fertilizers. This innovation was also introduced in the Novokemerovo and Novokuybyshevsk production associations, the Ionava nitrogen fertilizer plant and other enterprises of the industry, with a total economic effect of 4 million rubles.

In conclusion, I would like to extend sincere congratulations to all the comrades who earned the high rank of laureates of the BSSR State Prize and to wish them new creative achievements for Soviet science and technology.

SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

BONUSES FOR SCIENCE AND TECHNOLOGY IN THE UKRAINE

Kiev PRAVDA UKRAINY in Russian 8 Jan 77 p 3

[Article: "From the Committee on State Bonuses of the Ukrainian SSR in the Area of Science and Technology Under the Ukrainian SSR Council of Ministers"]

[Text] The committee is announcing the acceptance of materials for the competition for state prizes in the Ukrainian SSR in 1977 for outstanding achievements in labor.

These bonuses will be awarded to the leaders of the socialist competition -- workers, kolkhoz workers, engineering and technical personnel and collectives of brigades, sections, divisions, farms and teams who made outstanding achievements in labor last year.

The nomination of leaders of the socialist competition and the presentation of materials for the competition for state prizes of the Ukrainian SSR for outstanding achievements in labor are carried out: for enterprises and organizations of union jurisdiction -- by ispolkoms of oblast soviets of workers' deputies and oblast trade-union councils; for enterprises and organizations of union-republic and republic jurisdiction -- by ministries, departments and republic trade-union committees after summing up the results of the socialist competition for the past year.

Materials concerning the leaders of the socialist competition are considered in the collectives where they work and their nomination for competition for state prizes of the Ukrainian SSR is carried out in circumstances of high demandingness and objective and well-founded consideration of each candidate for the competition for the prize and his achievements in labor.

The acceptance of materials for the competition for state prizes of the Ukrainian SSR in 1977 for outstanding achievements in labor ends on 1 March 1977.

Materials submitted later than this date will not be considered.

For information concerning the policy for nomination and for filling out and submitting materials for the competition for state prizes of the Ukrainian SSR for outstanding achievements in labor, write to the Committee on State Prizes of the Ukrainian SSR in the Area of Science and Technology under the Ukrainian SSR Council of Ministers at the following address: 252021, Kiev, Ul. Kirova, 18/2, rooms 45, 46, telephone 93-05-81.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

A. L. SHAGINYAN

Yerevan KOMMUNIST in Russian 25 Dec 76 p 2

[Article by R. Aleksandrov and A. Talalyan, corresponding members of AS Armenian SSR: "Scientist, Teacher and Citizen--On the 70th Birthday of Academician A. L. Shaginyan"]

[Text] Professor of Yerevan University, Academician of the Academy of Sciences of Armenian SSR and Honored Worker of Science Artashes Liparitovich Shaginyan has reached his 70th birthday and has completed 45 years of scientific and teaching work.

All of the rich life of this distinguished scientist has been wholly dedicated to the development of science and higher education in our republic. He has rendered particularly great service in the development of the mathematical sciences.

A. L. Shaginyan was born in 1906 in Aleksandropol'. It was not possible for him to obtain a systematic education until after the establishment of Soviet power in Armenia. He then enrolled in an industrial tekhnikum. Following this he continued his education in the technical department of Yerevan University. However, his great love for mathematics led him to transfer from the fourth year to the physicomathematics department of the university's pedagogical school. In 1929, when Shaginyan was still a student, he was appointed to the position of assistant in the university's mathematics department, where he worked right up to 1934, studying with great enthusiasm the increasingly complex divisions of mathematics, including those which at the time were still not being taught in Armenia. This enabled him to enroll in 1934 in graduate study at Leningrad University. There, under the scientific direction of that remarkable scientist and superb teacher Academician Vladimir Ivanovich Smirnov, he achieved great success in studying the research accomplished in the field of the theory of functions.



Even in these years there was evidence of the brilliant scientific talent of A. L. Shaginyan, a talent which enabled him to obtain his inventive results in the theory of orthogonal polynomials and in the theory of approximation in a complex field; this research has proven to be of great scientific interest.

After successful completion of his graduate study, A. L. Shaginyan returned in 1937 to Yerevan and began his scientific and teaching work within the walls of his hometown university.

It was then he began for the first time to lecture on a number of new and important developments in present-day mathematics. His lectures were always thorough and absorbing and they excelled not only in profundity and clarity but in an extraordinary liveliness which induced the listeners to go deeply into the material presented, even if it was very complex.

These qualities of the superb scientist and lecturer and his personal magnetism helped to a great extent to stimulate in the most capable young mathematicians grouped around him the liveliest interest in scientific research.

In this respect an ever greater role was played by the scientific seminars and discussions he organized, where a relaxed atmosphere was provided for reports and discussions on many questions, including unsolved problems and one of the most important and most fascinating subjects of present-day mathematics--the theory of functions.

In addition to the great and fruitful scientific and pedagogical work in the university, which he carried out virtually by himself, A. L. Shaginyan continued to address himself in intensive fashion to his scientific research and he obtained superior results in the theory of approximation in a complex field, results which have met with a warm response in our country and abroad. He also compiled the subject matter of his doctoral thesis, which he defended at Moscow University in 1944.

By this time there had already gathered around A. L. Shaginyan a group of young but very gifted mathematicians who had begun their independent scientific activity.

Among these young mathematicians were some who subsequently themselves became prominent scientists with their own scientific interests. They made a substantial contribution to the development of mathematics in Armenia.

Of these mathematicians mention should of course first of all be made of the distinguished representatives of the native mathematical school, Academician of AS Armenian SSR M. L. Dzhrbashyan and Corresponding Member of AS USSR S. N. Mergelyan, whose scientific achievements are well known not only in our country but far beyond its borders.

In February 1945 the founding of the Academy of Sciences of Armenian SSR, with its staff under the supervision of A. L. Shaginyan, was followed soon afterward by the organization of the first scientific center, where important scientific research was begun on a broader scale both in the realm of mathematics and in mechanics. This center was the mathematics mechanics sector of AS Armenian SSR, which later became the Institute of Mathematics and Mechanics of AS Armenian SSR; the director of this institute right up to 1959 was Artashes Liparitovich.

In addition to his many years as a member of the presidium of the Academy of Sciences Armenian SSR and academic secretary of the department of physicomathematical sciences, A. L. Shaginyan, with characteristic energy and conscientiousness, also did a great deal to further the overall development of higher education in our republic.

For nearly half a century A. L. Shaginyan has been indefatigable in the conduct of fruitful scientific and pedagogical work within the walls of Yerevan University. As the founder and permanent head of the department of mathematical analysis and theory of functions, he is making a great contribution to the training of ever newer generations of highly skilled mathematicians.

Together with the education workers, the student body and the scientific community of the republic, we extend heartfelt congratulations to the hero of this anniversary and we wish him good health, long years of life and continued success in his noble work.

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